SOME NEW AND LITTLE-KNOWN SHORE-BUGS (HETEROPTERA-SALDIDAE) FROM THE AUSTRALIAN REGION

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[Read 9 Nov. 1950]

SUMMARY

This paper describes four new species of Saldidae—*Pentacora leucographa, Saldula coorongensis, S. brevicornis* and *S. psammobia*—which inhabit the shores of salt-water lakes and estuaries, or the banks of sandy creeks, in South Australia. Descriptions are given of the eggs and five immature instars of each new species.

In the laboratory all species were successfully reared in air-tight containers, the bottom of which were covered with damp blotting paper. They fed readily on dead *Drosophila* adults. Eggs were laid under the surface of the blotting paper and the young were removed as they hatched. This was necessary to prevent them preying on unhatched eggs. All instars of all species are predaceous. The processes of mating and copulation are described. In the field the eggs of *P. leucographa* and *S. psammobia* are laid into the stems of samphire plants and this probably applies to *S. coorongensis* also but has not been observed.

The characteristics of all known Australian genera are described, together with a key for their identification.

INTRODUCTION

Only four species of Saldidae have been previously recorded from the Australian region: *Acanthia reuteriella* Kirkaldy 1899 and *Acanthia cygni* Kirkaldy 1899, both fresh-water forms from Western Australia; *Acanthia salina* Bergroth 1893, from salt-water pools, Admiralty Gulf, N.W. Australia; and *Salda nicholsoni* Hale 1920, from Wentworth Falls, New South Wales. This present work has added three new species of *Saldula,* and one new species of *Pentacora*. Observations of their ecology and biology have been made, including the description of a complete life cycle.

The author wishes to acknowledge his indebtedness to Mr. D. C. Swan, Entomologist, Waite Agricultural Research Institute, and Messrs. H. Womersley and G. F. Gross of the South Australian Museum, for advice and guidance during the preparation of this work. All new material described herein is lodged in the South Australian Museum.

Key to the Australian Genera

1. Membrane with five areoles - - - - - Pentacora Reuter
   Membrane with four areoles - - - - - - - - 2
2. Membrane with base of inner areole extending more than two-fifths of its length beyond base of second areole - - - - - Salda Fabricius
   Membrane with base of inner areole extending less than two-fifths of its length beyond base of second areole - - - - Saldula Van Duzee

Pentacora Reuter 1912

Pentacora Reuter, 1912, Of Finska Vet. Soc. Forh., LIV, Afd. A., No. 12, pp. 7-10, Orthotype *P. signoreti* Guer.

Body oblong. Eyes converging slightly towards the front. Ocelli slightly distant or nearly touching. Rostrum reaching middle coxae. Second segment of

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antenna equal in length to width of head or distinctly longer. Pronotum narrowing moderately towards front, base wide, sides explanate, lateral margins rounded strongly towards tip or forming distinct angles. Callus not attaining lateral margins; a transverse impression behind middle of callus. Scutellum wider than long, bearing a transverse impression. Hemielytra distinctly punctate, often densely so and for the greater part bearing bristles. On corium the interior vein bifurcates towards tip, the branches reaching suture of the membrane. Membrane with five complete oblong areoles, the first or inner produced slightly beyond the base of second, its tip not attaining tip of second. Last sternite in female reduced, not covering genitalia. Hind tarsal segments unequal, the third somewhat shorter than second. Genotype:—*Acanthia signoreti* Guer.

Acanthia salina Bergroth 1893, should rightly be placed in this genus, on Bergroth's description of the membrane ("membrana cellulis quinque completis instructa"). The two Australian species may be separated as follows:

1st and 4th antennal segments equal in length - - - - *P. salina* Berg., 1893
1st and 4th antennal segments unequal in length, i.e., 4th antennal segment two-thirds longer than 1st - - - - - - - - **P. leucographa** sp. nov.

PENTACORA SALINA Berg., 1893

Acanthia salina Bergroth, 1893. Ent. Mon. Mag., 29, 279.

Salda salina Hale, 1924. Proc. Linn. Soc. N.S.W., 49, (4), 466.

Oval, dark-coloured, covered above with very dark hair, head, pronotum and scutellum shining. Hemielytra opaque. Spot on sides of pronotum narrowly continuing forward and behind to following margin. Posterior lateral edges of scutellum forming a V-shaped sign apically with the hind band of clavus. There is a median spot and a spot near the internal angles of the corium. Edges of acetabulum and posterior edges of metasternum and apical margins of ventral segments, legs and often frons slightly golden. Femora, except tip, and tip of tarsi black. Head (with eyes) distinctly wider than apex of pronotum, pronotum long medially. Frons with oblique black impressed line on each side. Antennae similar in colour, and in adult, first segment diametrically opposed seen unequally from above and provided with spurs unequally protruding; second two and one half times longer than first; third half as long again as first; fourth one-third part shorter than third. Pronotum and scutellum like soft leather, edges raised. Hemielytra not projecting beyond tip of abdomen. Corium and clavus clearly punctulate. Membrane with five complete cells which are dark and smoky with dark veins. Hind tibia and tarsus dark and spinous.

Pentacora leucographa sp. nov.

Holotype Male—Eyes prominent. Head, including eyes, distinctly wider than anterior of pronotum, slightly brownish, with inner edges of the eyes devoid of facets. Deep cleft between ocelli and eyes, gradually diverging from level of ocelli and meeting eyes half-way along their inner margins. Between eyes and this cleft is a raised light-coloured patch. At the posterior tip of this raised patch is a long bristle. Frons bearing a pair of bristles at its anterior edge and another pair half-way between these and the ocelli. Ocelli slightly raised, almost contiguous, dark orange. A pair of large bristles one-third of the distance from the ocelli to the neck and separated by a distance equal to the width of the ocelli. Rostrum dark-brownish, shining and extending beyond middle of hind coxae. Antenna with first and second segments whitish, with short black bristles. Third and fourth segments dark brown with short pubescence and a few long bristles. Total length of antenna 2·51 mm. Ratio of segments I; II; III; IV: 15 : 35 : 25 : 25. Ratio antenna to body length is 71 : 100.

Pronotum shining black with silver pubescence, lateral edges straight with large white patches extending nearly their entire length. Strongly convex callus extending two-thirds of length of pronotum. Fovea placed well in front of middle of callus; also two very slight depressions on each side about one-third of the distance from central fovea to lateral edge of callus. Scutellum shining black with short golden pubescence and very marked contours (fig. 1), the posterior half with transverse striations. Scutellum and pronotum with a few long bristles.

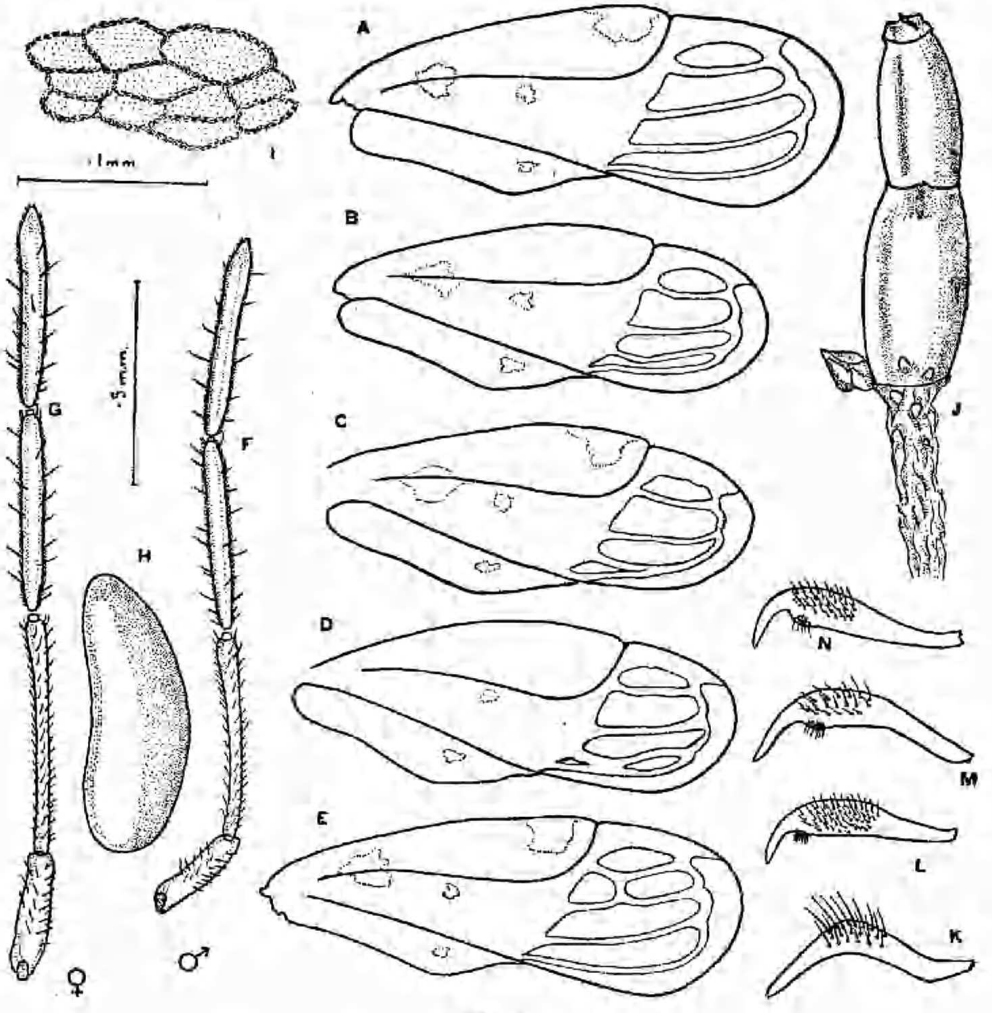


Fig. 1

Saldula psammobia—A. to E, variation in membrane venation; F, Male antenna; G, Female antenna; H, Egg; I, Surface of egg; J, Stem of samphire (*Salicornia* sp.) with eggs inserted; K - N, Parameres. K, *Pentacora leucographa;* L, *Saldula cooroongensis;* M, *Saldula psammobia;* N, *Saldula brevicornis.*

Clavus dull black with sparse, short, black pubescence and a few black bristles. A long white patch extending centrally in clavus for the posterior third of its length. Corium dull black with very spare short black pubescence and a few black bristles. A large white patch mid-way on outer edge of corium; also one at anterior and extending back along the inner edge narrowly for a greater or lesser extent. Corium with one median longitudinal vein bifurcating at its distal end, and a cross vein extending from point of bifurcation to embolium.

Embolium for the greater part shining black; posterior third dull black with sparse black pubescence. A whitish transparent patch opposite anterior white patch of corium. Also an opaque white patch at posterior end, extending the whole width of embolium. Membrane usually opaque and shining, but may be dull, brownish. Veins black and distinct with a few short black hairs. Outer edge of membrane dull black, with short black pubescence extending as far as tip of fifth areole.

Ventral surface shining black with short silvery pubescence. Prosternal area: propleura mostly white, portion of xyphus surrounding coxae white. Mesosternal area: sternal area surrounding coxae of mid-leg white, posterior edge of epimeron white. Metasternal area: posterior edge of metasternum white, sub-coxal flange white. Abdominal sternites shining black with short silvery pubescence, posterior edges whitish. Proximal end of coxae whitish, distal end brown. Tibiae whitish, inner surface with dark band running its whole length. Distal tip of tibiae dark brown. Second and third tarsal segments in hind leg differing in length, third being one-sixth shorter than second; first and third blackish, second white. Combined length of the hind femur, tibia and tarsus equal to body length, with proportions respectively of 31:50:19. Male length 3·50 mm.; width 1·4 mm. Female slightly larger than male: length 3·90 mm.; width 1·7 mm. Last abdominal segment truncate (typical of genus, see fig. 1). Antennal proportions different from male. Of a total length of 2·86 mm. the proportions of the segments are I:II:III:IV:14:42:22:22.

Type locality—Port Adelaide River Basin, South Australia.

The fourth and fifth vein in some variants of *P. leucographa* may closely approximate or actually coalesce for a greater or lesser part of their length. One variant (see fig. 2 e) has the veins fused completely for their proximal half, so that the fourth areole is much shorter than the third and fifth which are contiguous for a greater or lesser distance basally. This is of interest as it is the typical wing venation of a separate genus, *Chiloxanthus* Reuter.

The genus *Pentacora* has previously only been recorded from North America. The discovery of this Australian species shows that the genus may be much more widely distributed than has hitherto been suspected.

Salda Fab., 1803

Salda Fabricius 1803. Syst. Rhync. 113. Orthotype *S. littoralis* (Linn.) (= *S. zosterae* (Fab.).

To the references cited by Van Duzee 1917 may be added Saunders 1892, Distant 1904.

Body broadly oval or oblong oval in macropterous forms. Head deflexed, narrowing slightly towards front. Ocelli together. Rostrum reaching middle of hind coxae or a little beyond. Antennae slender, with short pubescence and a few long bristles. Second segment from two and a half to three times as long as first. Pronotum narrowing strongly towards front, apical margin slightly narrower than head; sides straight or rounded. Callus large, extending to three-fourths of width of pronotum. Base of pronotum widely emarginate. Scutellum wider than long, base plainly visible and always a transverse impression from the base. Hemielytra variably punctulate, always without silky black patches. Corium with veins joining, sometimes very slender or absent, interior vein bifurcating at its distal end, the bifurcations reaching the membrane. Embolium totally black. Membrane showing four complete areoles, base of the first or inner areole extending two-fifths or one-half beyond base of second, the apex also in the macrapterous forms placed above the apex in this way. Apex of second

areole not extending further than apex of third. Membrane often abbreviated. Wings for the greater part abbreviated or absent. Hind tarsal segments unequal in length. Last ventral segment in the female roundly produced. Genotype—*Acanthia littoralis* Linnaeus.

Salda nicholsoni Hale, 1924

Salda nicholsoni Hale, 1924. Proc. Linn. Soc. N.S.W., **49**, 465, pl. xlviii, fig. 4 a-d.

S. nicholsoni is the only authentic species of this genus yet recorded from Australia, being a fresh-water form collected from the base of a waterfall at Wentworth Falls, New South Wales.

Both *Acanthia reuteriella* Kirk. and *Acanthia cygni* Kirk. have been referred to as species of *Salda* by Hale (1924). As their descriptions give no clue to their generic identity, these species must be re-examined before designation to a genus. Both are fresh-water forms from Western Australia. Kirkaldy in his description of *A. reuteriella* says, "Posterior tibiae nearly three times as long as tarsi, first tarsal segment one-fifth longer than the second, which is twice as long as the large falciform claws." Apparently Kirkaldy has mistaken the numbers of tarsal segments, three being present in all Saldidae, the first being very short compared with the second and third which are nearly equal.

Saldula Van Duzee, 1914

Saldula Van Duzee, 1914 a, San Diego Nat. Hist. Soc., 2, 32; 1914 b, Can. Ent., **46**, 387.

Acantha Reuter 1895, Acta Soc. Sci. Finn., 21, (2), 5-9. Reuter 1912, Ofv. Finska Vet. Soc. Forh., liv., 14, (7), 71-72; idem (12), 8, 14.

Body oblong-oval, brachypterous forms obovate. Head subvertical. Ocelli almost contiguous. Rostrum attaining middle of intermediate or hind coxae. Antennae slender. Base of pronotum emarginate, sides straight or rounded. Callus not reaching lateral margins, but extending behind middle of pronotum. Scutellum wider than long, and bearing transverse impression. Hemielytra often with silky black spots. Corium with interior vein bifurcating towards tip, the branches reaching margin of membrane. Membrane showing areoles, spread out or abbreviated to a greater or lesser extent; if abbreviated, it nevertheless reaches tip of abdomen. Base of first or inner areole extending above base of second but not further than one-third its length. Apex of first areole reaching or nearly reaching apex of second. Third tarsal segment of hind leg shorter or longer than second. Last ventral segmen of female roundly produced. Genotype—*Acanthia saltatoria* Linn.

This is by far the largest genus in the family, and specimens of two other species besides those listed below have come to my notice, one from Launceston, Tasmania; and one from Vivonne Bay, Kangaroo Island, South Australia.

Key to New Species

1. Combined length of femur, tibia, and tarsus, shorter than body length **S. coorongensis** sp. nov.
   Combined length of femur, tibia, and tarsus equal to body length - - - 2
2. Second antennal segment one-third longer than the third - **S. brevicornis** sp. nov.
   Second antennal segment only slightly longer than the third - **S. psammobia** sp. nov.

Saldula coorongensis sp. nov. (fig. I, L)

Holotype Male—Head, pronotum and scutellum shining black, covered with short golden pubescence. Embolium for the greater part shining black with

golden pubescence. Corium and clavus dull black, not shining, having grey patches; also bearing golden and black pubescence. Membranes without pubescence.

Eyes prominent, slightly brownish, with the inner edges devoid of facets. At junction of eyes with notocephalon a slightly raised, circular, light brownish area bearing a long brsitle, approximately ten times length of body pubescence. This area is the same size as the ocelli but not quite as spherical. Ocelli, almost contiguous, orange brownish, their approximating edges joining a raised portion of head. Frons bearing two pairs of long bristles, one pair near anterior margin, second pair half-way between these and ocelli. Two deep clefts diverging from ocelli and passing forward to anterior edges of eyes. Region of head behind ocelli without pubescence and deeply pitted. Rostrum light brownish, reaching mid-coxae of hind legs. Third and fourth segments of antenna thickly pubescent, with a few bristles; total length 1·58 mm., the ratio of segments is: I:II:III: IV: : 18:31:25:26. Antennae reach to ·46 of distance from front of head to tip of hemielytra. Pronotum shining black, bearing short golden pubescence. Callus extending slightly behind middle of pronotum; with a distinct fovea slightly in front of centre and a very slight depression one each side about one-third of distance from fovea to lateral edges of callus. Lateral edges of pronotum rounded. Scutellum shining black with short golden pubescence with very marked contours. Posterior half bearing transverse striations. Clavus, dull black, sparsely pubescent, with a whitish grey spot at posterior inner end, just behind apex of scutellum. A cross vein joins junction of this bifurcation with margin of embolium. Inner areole of corium dull greyish, with both black and golden pubescence. Anterior outer areole bearing a whitish patch at one half of its length from anterior end, and one at its posterior end, but chiefly black with greyish patches, and with both black and golden pubescence. Posterior outer areole dull black with golden pubescence. Posterior central areole greyish. There may or may not be a whitish patch opposite to that of corium; also a whitish patch at hinder margin of embolium with membrane extending whole width of embolium, or divided into an inner crescentic patch and an irregular outer patch. Membranes opaque, with irregular blackish and whitish patches; veins black, bearing a few short black hairs; outer margin of membrane black with short black pubescence and a whitish patch at its mid-point. Ventral surface of body black and shining, with short golden pubescence, posterior edge of each sternite yellowish. Femur with a series of brown spots along its whole length. Hind tibia slightly curved and bearing heavy bristles. Second and third tarsal segments equal in length. Combined length of hind femur, tibia and tarsus ·85 of body length. Proportions of femur: tibia: tarsus 32:47:21.

Length 3·47 mm.; width 1·6 mm.

Allotype Female—Length 3·80 mm.; width 1·80 mm. Ovipositor prominent. Last ventral segment roundly produced. No sexual dimorphism in antennal measurements.

Type locality—McGrath's Flat, Coorong, South Australia.

Saldula psammobia sp. nov.

Holotype Male—As for *S. corrongensis* except for dimensions and body pubescence; the latter slightly longer and more sparse than in *S. coorongensis*. In a total length of 1·74 mm. proportions of antennal segments are I:II:III: IV: :15:30:27·5:27·5. Antennae reaching ·59 of distance from front of head to tip of hemielytra. Combined length of hind femur, tibia and tarsus equal in length to body. Length of male—2·97 mm.; width 1·4 mm.

Allotype Female — Slightly larger than male. Length 3·38 mm.; width 1·7 mm. Ovipositor prominent. Last segment ventrally produced. Marked sexual dimorphism of antennae. Antenna length 1·90 mm. the ratio of I: II: III: IV:: 16: 32: 26: 26. This sexual dimorphism is very striking, the second segment of the antennae in the male being only slightly longer than the third, while in the female it is one-fifth longer.

Type locality—Port Adelaide River Basin.

This species shows considerable variation in wing venation and also in length of body pubescence. A continuous series of variants can be taken showing gradation from the typical four-celled membrane to a much reduced three-celled stage. The reduction occurs by the coalescing of the first and second veins. The veins themselves may vary from a definite black type to a hazy indefinite form scarcely distinguishable from the membrane itself. A cross vein may rarely be found extending across the third areole dividing it into two complete cells. As can be seen from the accompanying figure, the variant with the reduced inner areole has a much smaller membrane, the venation of both membranes clearly showing when the insect is at rest, no overlapping occurring as in the normal individual. This is the brachypterous form which is figured in the text. Variation also occurs in the length of the body pubescence in general appearance from the normal individual.

Saldula brevicornis n. sp.

Holotype Male—Head, pronotum and scutellum as for *S. coorongensis*, but the surface of the scutellum and pronotum are slightly irregular, having numerous closely placed small depressions. Antennae with third and fourth segments much darker than second and with thick pubescence and few short bristles; first and second segments without this pubescence but with numerous bristles. Antenna length 1·47 mm.; ratio of segments I: II: III: IV:: 16: 32: 25·5: 26·5. Antennae reach to ·46 of distance from front of head to tip of hemielytra. Clavus very dark brown, very slightly shining, and with short golden pubescence, whitish spot at posterior inner end just behind apex of scutellum. Corium with venation as in *S. coorongensis*. Similar in colour to clavus, with golden and black pubescence. Outer edge of corium with a white spot half-way from anterior edge to cross vein, also a smaller white spot just anterior to this cross vein. Posterior outer tip of corium with a light patch. Embolium similar in colour to corium, bearing golden and black pubescence. A whitish transparent patch opposite the anterior patch of corium extending the width of embolium and becoming, at the outer edge, one quarter the length of the embolium. Also a whitish patch at hinder margin of embolium, with membrane extending whole width of embolium, or more usually divided into a crescentic inner patch and an irregular outer patch. Membrane with four areoles, transparent. Veins black and definite, bearing a few short black hairs. Outer margin of membrane dark brownish with short black pubescence and a whitish patch at its mid-point. Ventral surface of abdomen black or dark brownish with short golden pubescence. Legs whitish and transparent except for last tarsal segment and distal end of tibia and junction of tibia and femur which are dark brown. Combined length of femur, tibia and tarsus equal in length to the body, of relative proportions 31: 49: 20. Second and third tarsal segments equal in length.

Length 3·22 mm., width 1·45 mm.

Allotype Female — Slightly larger. Length 3·45 mm., width 1·62 mm.

Type locality—Wilson, South Australia.

ECOLOGY

Pentacora leucographa

This species has been collected throughout the Port Adelaide River area and inhabits tidal areas bearing samphire, and salty marshes. The area north of Adelaide has been inspected as far as Port Wakefield and, although no specimens were collected, this was probably due to inexperience or seasonal fluctuations. These insects move in short, rapid jumps of as much as eighteen inches and are difficult to detect as they usually occur along with shore flies, which they resemble in size.

Saldula psammobia

This species is restricted to the same localities and habitats as *P. leucographa*. Although it is sympatric with the latter there is a marked difference in their seasonal variation, *P. leucographa* disappearing entirely during the winter months from March onwards, the eggs apparently being the overwintering stage, while *S. psammobia* occurs until August, although gradually falling off in numbers after March. It is highly probable that further collecting will show this species to be present along the shore of St. Vincent Gulf, north of Adelaide, as there are numerous suitable localities and no apparent ecological barriers.

Saldula brevicornis

This species has been collected from Mount Serle, Flinders Ranges, to Wilson, South Australia. It inhabits the borders of pools and streams. Specimens have also been collected at various points along the River Murray, at Adelaide, and throughout the southern Mount Lofty Ranges. As there is a suitable network of rivers extending throughout the northern parts of South Australia and also into the eastern States, the distribution of this species should ultimately be shown to be fairly extensive.

Saldula coorongensis

This species has been collected in the Coorong, South Australia, from Kingston (South-East) to Lake Alexandrina. It occurs along the water margins where samphire is growing but is in greatest numbers at the junction of the samphire areas with the grass-bearing soil margins, and apparently breeds throughout the whole year, all instars being readily collected in mid-winter.

The fact that the ranges of distribution of *S. psammobia* and *S. coorongensis* were allopatric by a distance of only 50 miles, necessitated experiments to determine if they would interbreed. No interbreeding was found to occur.

BIONOMICS AND DESCRIPTION OF IMMATURE STAGES

So far as is known, all members of the family are predaceous. *Saldula psammobia* appears to feed chiefly on shore flies. All instars feed on larvae near the surface of the sand and continually probe the sand with their rostra in search of food, readily feeding on younger instars and the disabled of their own kind. *Pentacora leucographa* and *Saldula coorongensis* exist on the same diet. The above three species together with *Saldula brevicornis* were successfully kept in the laboratory in air-tight containers, the bottoms of which were covered with moist blotting paper. The saldids had no hesitation in feeding on dead ferment flies of *Drosophila* sp., which were introduced daily. When reared in these containers, care must be taken to remove the young instars as soon as hatching occurs, as they feed readily on the eggs which are inserted just below the surface of the blotting paper.

Mating was observed in the laboratory and in the field, and in each case a definite courtship occurred before-hand. All four new species described in this paper behaved in a similar manner. The female remains motionless after the male approaches. They touch antennae, the male becomes agitated and mounts the female's back with a sudden spring, and thence moves to her side, copulation occurring while the two bugs are side by side. The male's right or left wing becomes displaced, and the genital apparatus of both bend towards each other. The genitalia are perfectly symmetrical, there being no particular preference for one side, the same pair repeatedly copulating from either side. The female may walk around during copulation, the male securely retaining his position, but definitely not by the use of his displaced tarsi or tibiae, although it is possible that the coxae or femora may have some action in this respect. The male must be rapid in his approach and retreat from the female, as she makes deliberate attempts to insert her rostrum into his body.

Eggs are normally inserted into the fleshy stems of samphire by *Saldula psammobia*, *Pentacora leucographa*, and also presumably by *S. coorongensis*, although no eggs of this species have as yet been obtained in the field; in the laboratory they prefer samphire to sand. These species, as well as *S. brevicornis*, when kept in the laboratory on moist blotting paper, inserted their eggs in the paper around the edges of the containers. The eggs of the three new *Saldula* species all have a finely ridged surface, probably due to the impressions caused by the follicular cells of the ovarioles during maturation. Any accurate comparison of the eggs is not practicable, all varying within the same limits, the average size being 0·7 mm. long and 0·25 mm. wide. The eggs are whitish, the anterior being slightly pointed, the posterior pole somewhat wrinkled. Eggs were obtained from *Saldula psammobia* by two methods. The first was in containers with a layer of sand on the bottom of samphire placed therein. The second was with damp blotting paper. Those eggs inserted in the plant tissue had their posterior poles, which were usually wrinkled, protruding, whereas those in the blotting paper were devoid of such an area. Eggs were also dissected from the oviducts of *S. psammobia* and these were without any trace of the so-called micropyle region. This clearly suggests that doubt must be placed on Brindley's interpretation (Brindley 1934) of this area, which she describes in the egg of *Salda littoralis* as being ill-defined and occurring on the posterior pole of the egg which is left protruding from the surface of the mud in which it is laid. A likely explanation is that the unequal exposure of this posterior pole results in localised surface stresses being set up which give rise to the wrinkled area.

Saldula brevicornis

This species was reared through all stages in the laboratory using the technique already described. The eggs were incubated at 24° C. and 100% humidity. At two days the eggs became yellowish and eyespots began to show. At three days eyespots were large and prominent. The first instars emerged at five days and fed readily. These moulted at three days. The second instar moulted after another three days. The third, fourth and fifth instars took four days each. There was definitely no post-natal moult, such as occurs in the Hebridae and other closely related families.

The first instar is of a light brownish colour with prominent yellow eyes. The first, second and third antennal segments are slender and approximately equal in size. The fourth segment is somewhat longer and much expanded. There is a prominent, light-coloured, Y-shaped line, extending forward from the first abdominal segment to the head along which splitting occurs during ecdysis. The pronotum has a transverse groove extending nearly its whole width. This is

composed of three definite curves. There is a red-coloured repugnatorial gland closely underlying the dorsal surface of the abdomen. The legs are approximately equal, the hind pair being somewhat longer. There is only one tarsal segment.

The second instar is slightly darker. The fourth antennal segment is proportionately not so large as in the first instar, but nevertheless is considerably larger than the third segment. The mesonotum has a slight transverse depression. The edges of the thorax and abdomen are slightly explanate. The third abdominal tergite has a rounded projection posteriorly at its mid-point. This is apparently connected with the bland mentioned in the first instar. The hind legs are slightly longer than the other pairs but only possess one tarsal segment.

The third instar is brownish with a prominent light-coloured suture. The fourth antennal segment is larger than the others. The sides of the thorax and abdomen are definitely explanate. The meso- and metanotum have started to expand posteriorly. The hind tarsi show the differentiation of the first tarsal segment.

The fourth instar is dark-coloured with a prominent light-coloured suture. The head shows the three pairs of bristles characteristic of the adult. The third and fourth antennal segments are equal in length and are somewhat shorter than the second. The pronotum and mesohotum show further differentiation. The lateral edges of the pronotum are explanate, the posterior edge is flat and the callus is well developed, and shows the depressions that form the fovae. The mesonotum shows further differentiation. The wing-buds are well developed and the central portion shows characteristic contours. The abdomen has explanate sides. The third abdominal segment shows the same structure as earlier mentioned. The hind legs are much longer than the front. The tarsi of the fore, mid and hind legs show the differentiation of the first tarsal segment.

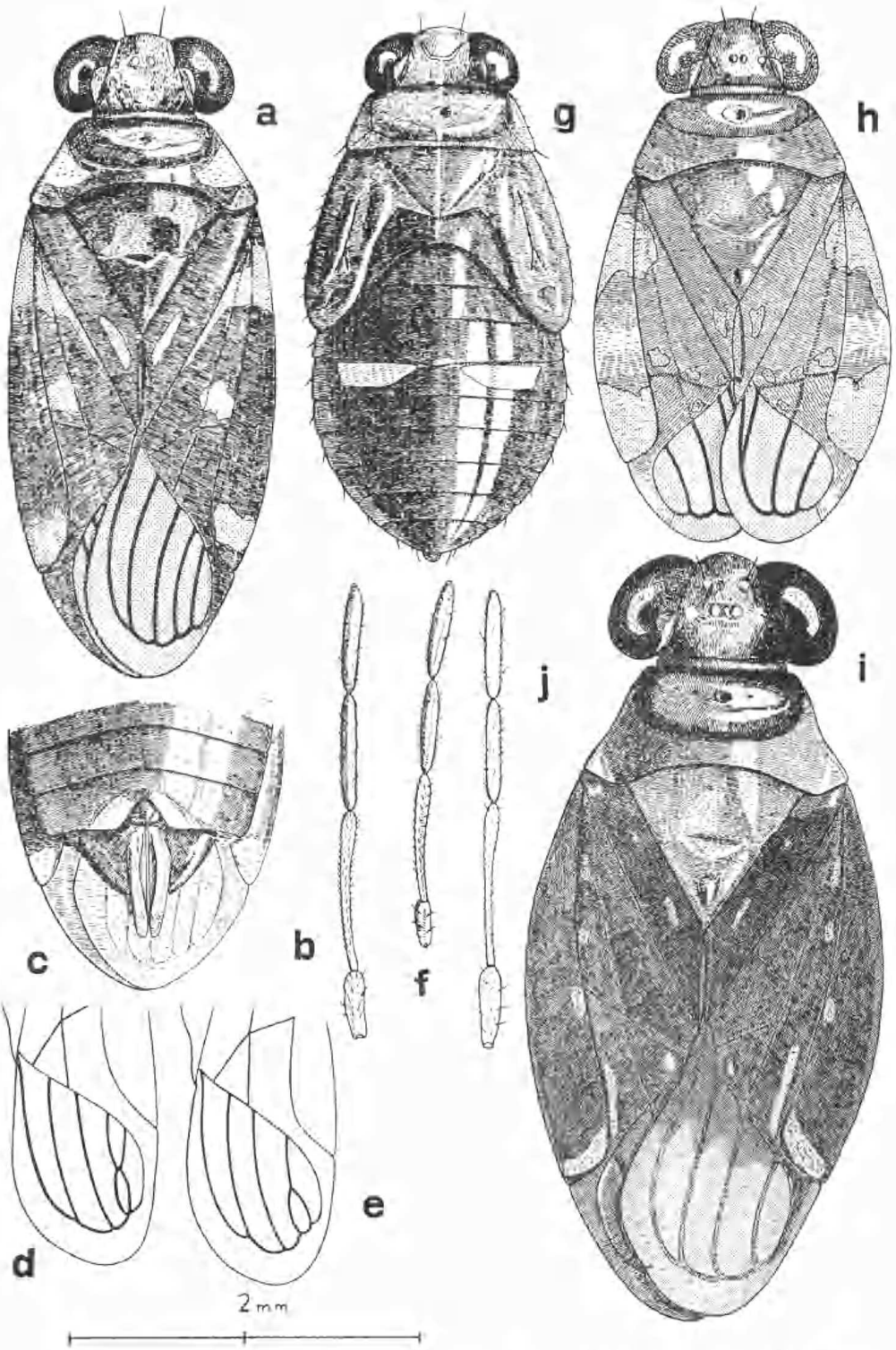
The fifth instar is much larger than the fourth, being only a little shorter than the adult. It is dark-coloured with a definite white pattern. The eyes are more prominent than in the previous instar. The second antennal segment is longer than the third and fourth which are equal. The two diverging grooves which run just in front of the ocelli in the adult are present. There is a dark polygonal patch between the eyes. The pronotum is similar to that of the fourth instar. The mesonotum is complexly contoured and has three pairs of definite white patches on the central portion. The wing buds are further developed. The metanotum has extended further back, the posterior tips of the meso- and metanotum coinciding. The abdomen has explanate lateral edges, the third abdominal segment showing the structure earlier described There is a definite colour pattern. The hind legs are much longer than the other pairs, the first tarsal segment being the only one differentiated, although the region of the second and third is closely shown by the colour pattern.

Saldula coorongensis

Eggs were obtained from specimens kept in the laboratory and incubated at 27° C. and 100% humidity. Time of hatching was five days. The instars resemble very closely those of *S. brevicornis*.

Saldula psammobia

The instars do not differ significantly from those of *S. brevicornis*, except for the fifth which lacks the elaborate pattern of this species, the body surface being brownish-black or light brown. There is a prominent light-coloured Y-shaped suture line present.



A, *Pentacora lemniographa*, adult male. B, Antenna. C, Ventral surface of female. D, E, Variations in membrane. F, Antenna, fifth instar. G, Fifth instar. H, *Salduda psammobia*, brachypterous form. I, *Salda nicholsoni*, adult male, with antenna J.